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(56) Documents cited
GB 2106211 A GB 1571896 A GB 1502869 A
GB 1374541 A GB 1294377 A GB 1158123 A
GB 1008117 A

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UK CL (Edition J) F2M MB2 MD1
INT CL⁴ F16B

(54) Quick release joint

(57) A structural joint between two panels which upon application of a retention force R is resistant to forces acting in the direction Y and in the direction Z, and to moments in the direction C about the axis of the joint. Each panel has one edge corner formed in the shape of crenellations, with the cranellations being tapered in their thickness so that the opposite edge corner is a straight line.

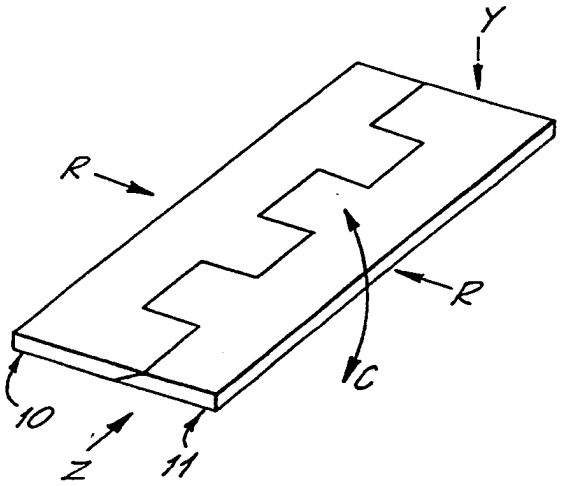

FIG.3.

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FIG.1a.

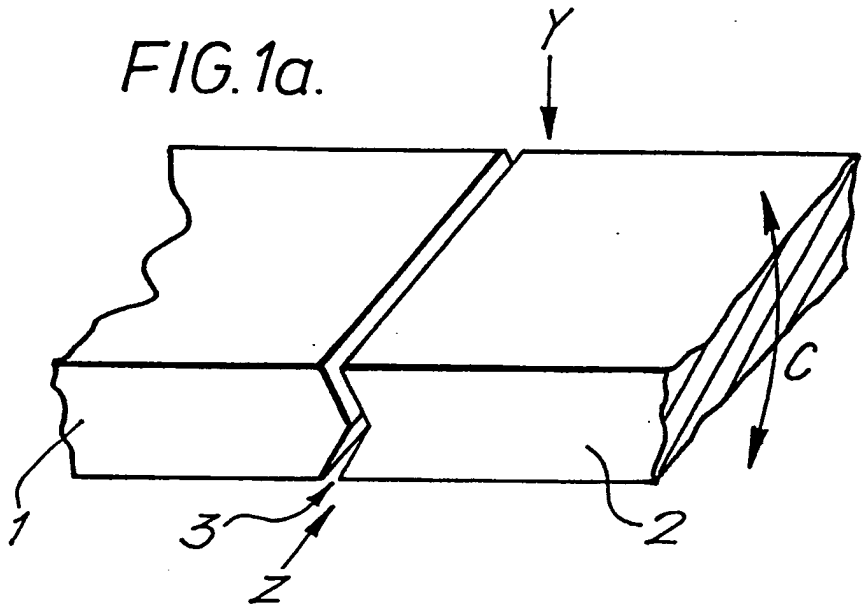


FIG.1b.

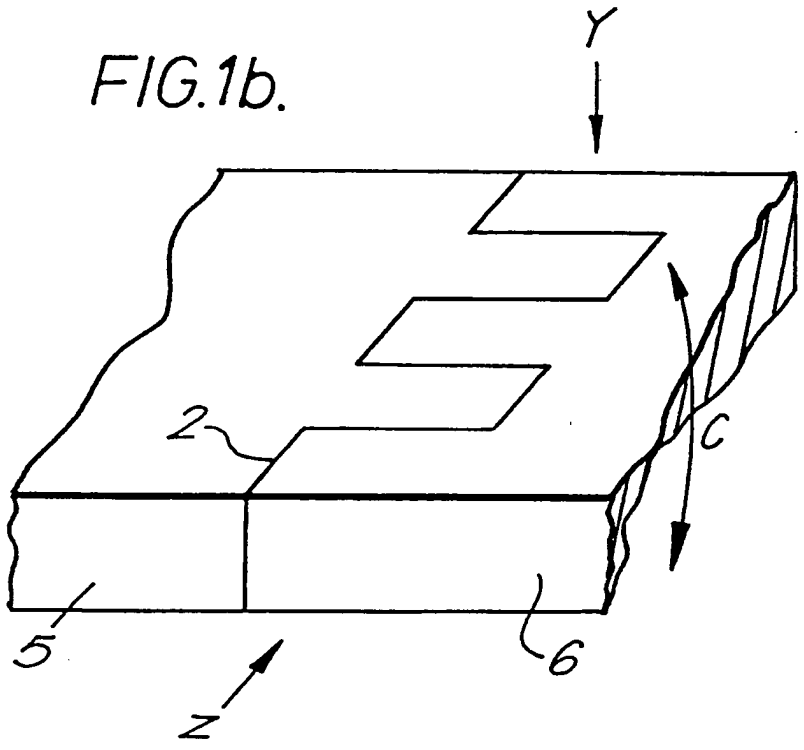
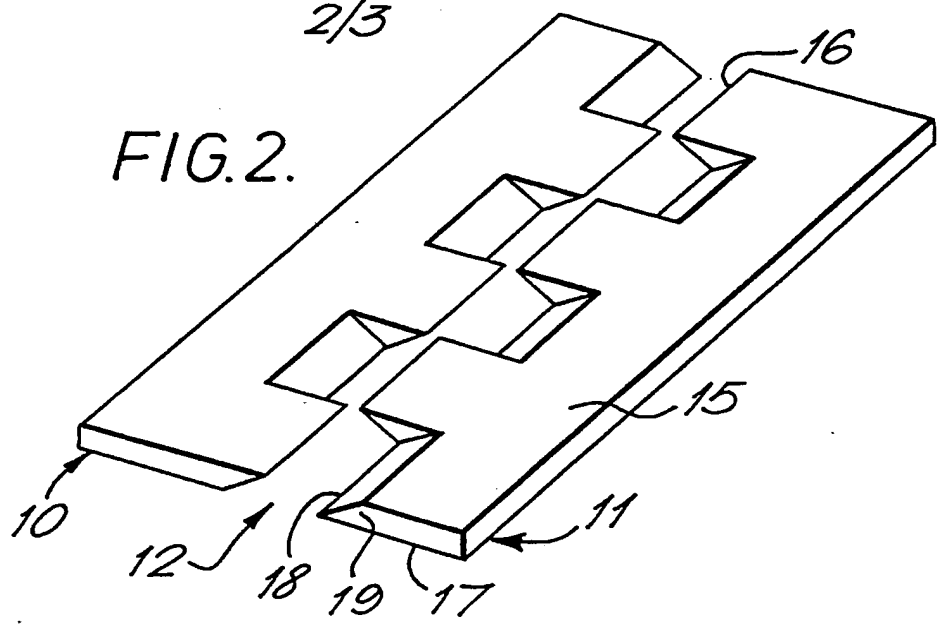


FIG.2.



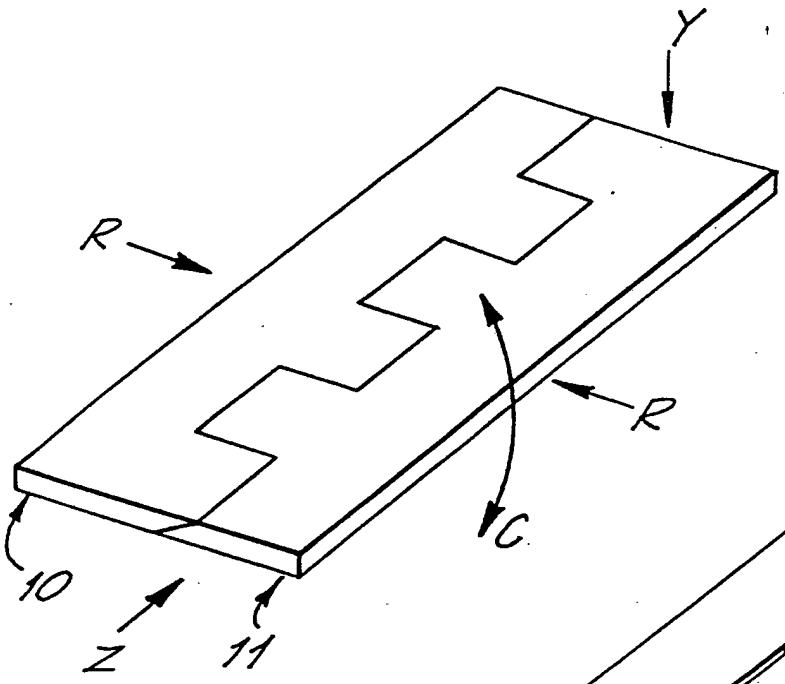


FIG.3.

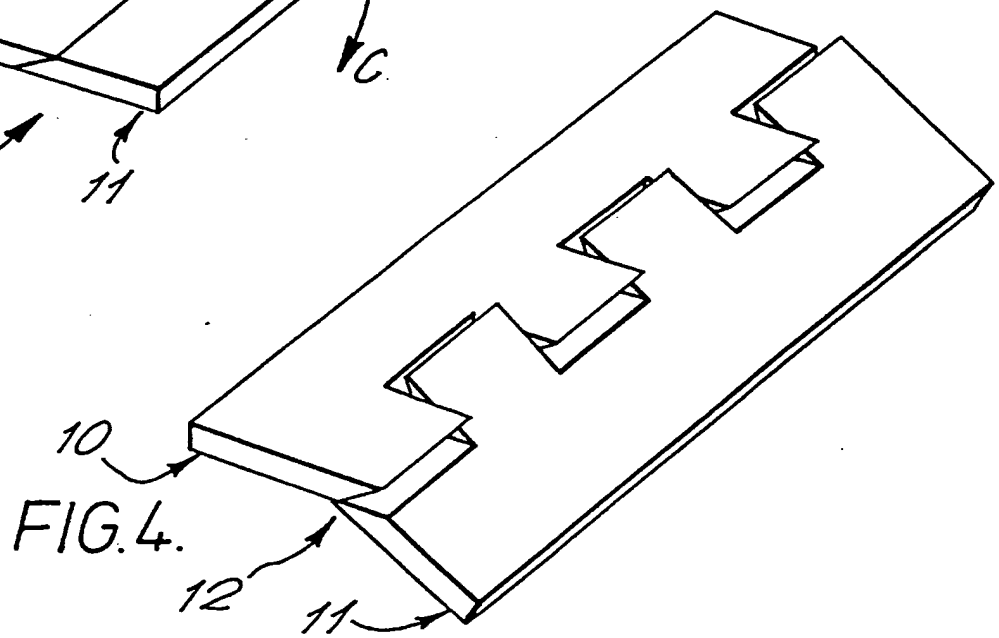


FIG.4.

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FIG.5a.

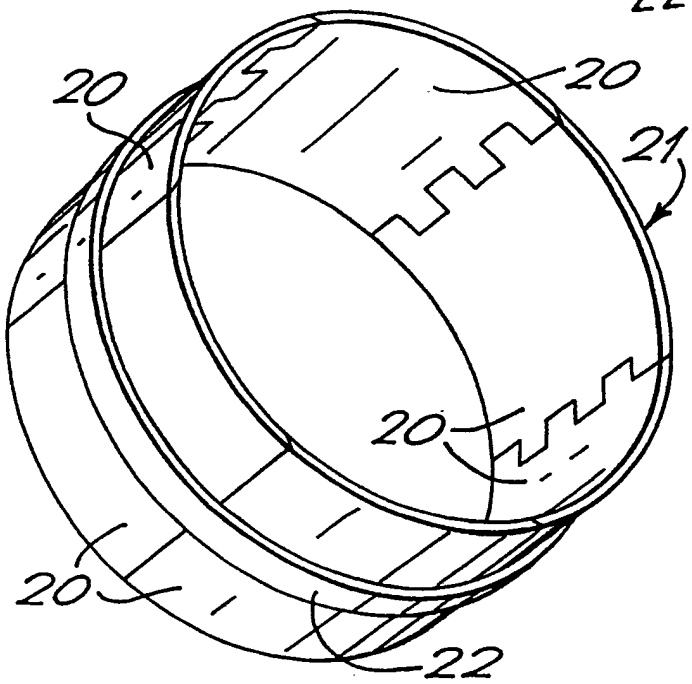
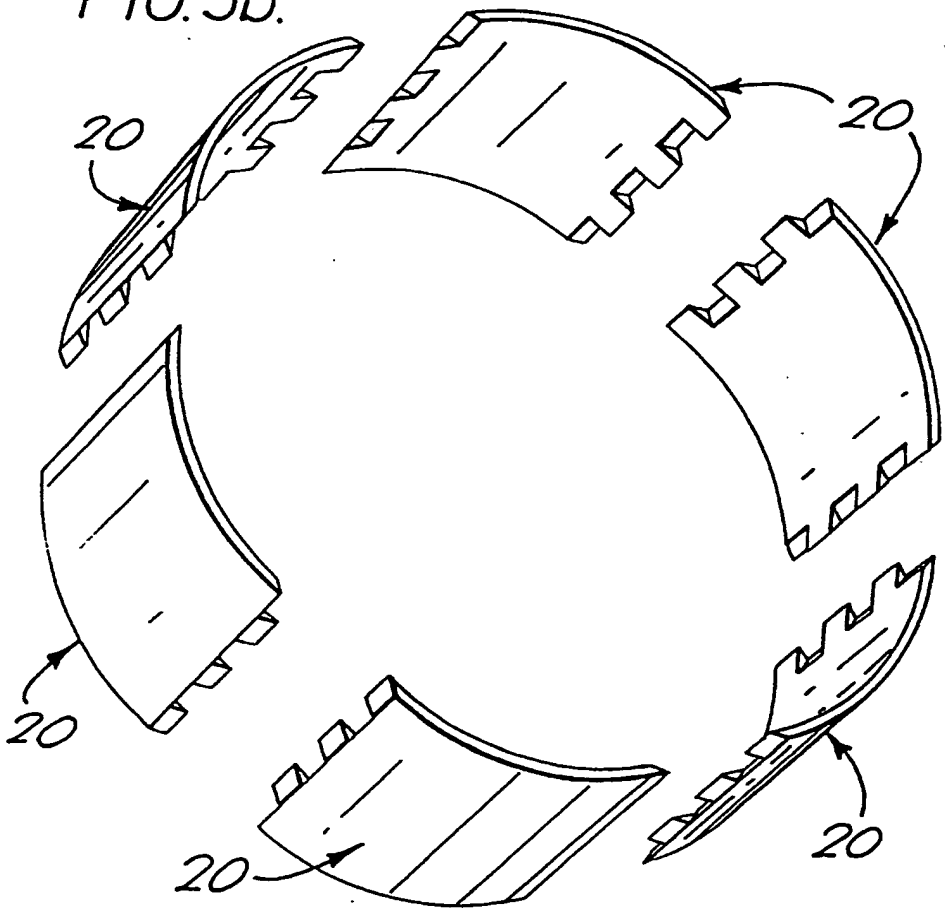


FIG.5b.



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QUICK RELEASE JOINT

This invention relates to quick-release structural joints.

Quick-release joints for use with panel-like members are seldom designed to maintain full structural performance by preserving shear strength along the line of the joint. This is largely because those features of the joint which are necessary to maintain the structural integrity tend not to be capable of quick-release operation.

Where shear-strength and quick release function are essential in one joint, it has become customary to employ explosive means to effect the quick-release function. Explosive charges may be laid to define a path where a panel is to be cut away (line cutting charge) or bolts may be employed in the panel fixings which can be severed by detonation of an integral charge (explosive bolts). However, any explosive process of this kind implies appreciable safety hazard at manufacture and in use, reflects undesirable shock disturbance back into the structure and panels when activated, and introduces an untestable (one-shot) feature into the design.

The invention is generally based on the provision of a quick release joint which maintains structural integrity, and which is particularly suited for use with panel-like members, and includes in its prefered form a combination of butt-joint and dove-tail principles. It is desired to provide a joint having a high resistance to shear load along the line of the joint subject to a certain retention condition, but which may be released readily by a partial,

angular or hinge-like rotation about the line of the joint.

According to one aspect of the present invention there is provided a structural joint between two panels having an axis lying in a first direction wherein, upon the application of retention force means substantially perpendicularly to the first direction and parallel to the plane of the panels at the joint, the said joint is resistant to movement under a resultant force applied to the panels in a direction parallel to the joint, and under a resultant force applied to the panels in a direction perpendicular to the joint and normal to the plane of the panels at the joint, and under a resultant movement about the axis of the joint.

According to another aspect there is provided a structure comprising at least two panels, wherein the panels are interdigitated along one edge, the panels being complementarily tapered to abut each other in alternate directions along the edge such that, under the influence of a retention force, the interdigitations provide resistance to relative movement between the panels parallel to the edge, and the abutting tapered surfaces provide resistance to relative movement normal to the plane of the panels at the joint and to relative rotation about the edge.

Some specific embodiments will now be described by way of example with reference to the accompanying drawings in which:

Figures 1 (a) and (b) show examples of the prior art;

Figure 2 shows a joint according to an embodiment of the present invention prior to assembly;

Figure 3 shows an assembled joint according to the embodiment shown in Figure 2;

Figure 4 shows the joint of Figure 2 during the release process; and

Figure 5 (a) and (b) show a cylinder formed from quick-release panels according to the invention.

Figure 1 (a) depicts a simple butt joint between two panels 1 and 2 with a 'V' form at the interface 3. If the faces of the joint are urged together by some retention force (not shown), then the joint is highly resistant to differential forces acting in the plane 'Y' and to rotation in the direction of arrow 'C' but offers little resistance to differential forces acting in the direction of arrow 'Z'.

Figure 1 (b) depicts a simplified dove-tail joint 4 between two panels 5 and 6, which is resistant in the direction of arrow 'Z' and to rotation in the direction of arrow 'C', but weak in the direction of arrow 'Y'.

According to the present invention these concepts are adapted and combined to produce a novel quick-release joint. Figure 2 shows the joint 12 between two panels 10 and 11 before assembly and Figure 3 shows them in the jointed position. The panels are formed such that on one side 15 of each panel the abutting edge 16 appears to be indented in

the form of crenellations, but on the reverse side 17 of the abutting edge appears as a straight line 18 at the centre line of the joint. Across the depth 19 of the panel the edge face is tapered in alternate directions to provide smooth, planar transition surfaces between the two edges 16 and 18. The indentations on panel 10 co-operate with the complementary indentations on panel 11 so that the two panels fit together snugly. With retention forces applied as shown by the arrows 'R' in Figure 3, the joint 12 is highly resistant to differential forces acting in the planes 'Y' and 'Z', and to rotational forces acting in the direction of arrow 'C'. On removal of the retention forces the joint is easily released by a partial, angular or hinge-like rotation about the centre line of the joint as shown in Figure 4.

It should be noted that with retention forces applied, the joint tends to hinge far more readily in one angular direction than the other, and this feature may be utilized to advantage in specific applications.

In certain configurations, for example when a series of curved panels are grouped to form a cylinder, the methods of retention and release become relatively safe and simple. If explosive means are necessary, they may be reduced to a simple, enclosed, cable shearing function exerted by one or more gas-motors, providing comparative freedom from safety hazard, and improved reliability via redundancy.

Figure 5 (a) shows how quick-release joints according to this invention might be used with a series of curved, panel-like members 20 to assemble a relatively firm cylindrical structure 21, with the ability to be dis-assembled rapidly and easily. The individual joints are

so formed that the property of the joint which inhibits rotation in one direction about the line of the joint prevents inward collapse of the assembly, whilst retention forces are easily maintained by use of one or more hoops 22, about the periphery of the cylinder as shown. Release of the hoop or hoops for example by removal of a retaining pin, removes the retention forces, allowing individual panel-like members to move apart, hinge outwards and release from each other. Figure 5 (b) is an exploded view of the assembly with the hoop removed.

It will be appreciated that this joint concept may be utilized in many different ways. In the cylindrical structure shown in Figures 5 (a) and (b) for example, the mating portions of each joint could be engineered either with a radius to the axis of the cylinder to give a circumferential plane to the joint, or to have a linear form with a tangential plane to the joint. Equally, it could be used to interface two mating faces at right angles, providing a structurally strong but quickly released retention - as might be required for a box lid.

The joint concept readily lends itself to simple, non-critical workshop operation and low cost production techniques.

CLAIMS

1. A structural joint between two panels having an axis lying in a first direction wherein, upon the application of retention force means substantially perpendicularly to the first direction and parallel to the plane of the panels at the joint, the said joint is resistant to movement under a resultant force applied to the panels in a direction parallel to the joint, and under a resultant force applied to the panels in a direction perpendicular to the joint and normal to the plane of the panels at the joint, and under a resultant movement about the axis of the joint.

2. A structural joint according to claim 1 wherein, upon removal of the retention force means, the joint may be readily released by pivoting at least one of the panels through a small angle around the axis of the joint.

3. A structural joint according to claim 1 or claim 2 wherein each panel comprises two faces separated by the thickness of the panel, and edges which in co-operation with the other panel form the joint, and wherein on one face of each panel the edge is crenellated, and on the other face of each panel the edge lies in a straight line along the axis of the joint, the panel being tapered across the thickness to provide smooth transition surfaces between the edges.

4. A structural joint according to claim 3 wherein the crenellations and transition surfaces on one panel are formed to provide a complementary fit with the crenellations and transition surfaces on the other panel.

5. A structural joint according to any preceding claim wherein the panels are each curved about a second axis and the axis of the joint is parallel to the second axis.

6. A structural joint according to any preceding claim wherein the retention force means comprises at least one cable.

7. A structure comprising at least two panels, wherein the panels are interdigitated along one edge, the panels being complementarily tapered to abut each other in alternate directions along the edge such that, under the influence of a retention force, the interdigitations provide resistance to relative movement between the panels parallel to the edge, and the abutting tapered surfaces provide resistance to relative movement normal to the plane of the panels at the joint and to relative rotation about the edge.

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